International Research Journal of Education and Technology

Peer Reviewed Journal

ISSN 2581-7795

REGIONGROWING TECHNIQUE BASED ON BIO INSPIRED FIREFLY ALGORITHM

M.MarySynthuja Jain Preetha[1], K.S.Vijula Grace[2], D.Shahi[3], T.Gopalakrishnan[4]

[1,2]*(Associate Professor, ECE, Noorul Islam Centre for Higher Education, Kumaracoil,India)*

[3,4]*(Assistant Professor,ECE, Noorul Islam Centre for Higher Education, Kumaracoil, India)*

Abstract

A threshold optimization technique using the nature inspired Firefly algorithm for color image segmentation is proposed in this paper. Initial seeds are selected by segregating the image into several blocks. The proposed algorithm comprises two stages: During the first stage, a region growing algorithm is proposed in which regions are grown based on a particular threshold. Regions are grown based on the intensity. In the next phase, the threshold used for growing regions is optimized using firefly algorithm. Texture characterization is made using local entropy computation. . This obtained texture characteristic and the region growth map of the fully grown regions are considered for merging procedure. The performance of the proposed segmentation algorithm is evaluated using the images taken from the Berkeleydataset.

Keywords: Region growing, Metaheuristic, Optimization, Firefly, Texture Character.

1. Introduction:

Image segmentation is a very tedious process in image processing. Segmentation is used to extract any useful information or any object from an image. Based on the application, region of interest may differ and hence none of the segmentation algorithm satisfies the global application (ie) any algorithm which is designed for one application may not be used to segment other images. (algorithmwhich detect tumor in brain images may fail to detect tumor in lungs). Hence itcan be noted that there is no single standard approach to segmentation. Selection of segmentation algorithm depends on the application and image types. A common definition for segmentation found in the literature is that " it is the process of partitioning the set of pixels in an image in to several disjoint subsets, according to a set of predefined criteria". The automatic image segmentation technique can be classified as 1) Segmentation based on thresholding 2) Boundary-Based Segmentation 3) Region-Based Segmentation 4) Hybrid techniques.

Many segmentation algorithms have been proposed in the literature whereedge, color and texture were considered as the basic metric for segmentation. Numerous segmentation algorithms have been executed to fragment gray scale images[1]. Thresholding based segmentation is done by assigning the pixels to either a background or foreground based on the chosen threshold. Usually thresholdingis done to segment gray scale images [2] – [4]. Colourimages can be segmented using boundary based segmentation. In images presence of boundaries leads to a abrupt change in the pixel intensities. This is the basic assumption in boundary based segmentation [6] – [8]. Regions are defined as a group of pixels connected with similar properties. Region based segmentation is done by grouping pixels together which are neighbors and have similar values and splitting group of pixels which are dissimilar in value [9] – [12]. Hybridmethods combine region based and boundary based segmentation toimprove the segmentation results [13] – [18].

Optimization is the process of making something effectiveorperfect as possible. While designing optimization algorithm, the objective is todesign an algorithm which will maximize its performance. An optimization algorithm is a procedure which is executed iteratively by comparing various solutions till an optimum or satisfactory solution is found. There are various algorithms used to solve optimization problems. Some well known algorithms are, Particle Swarm Optimization (PSO), Artificial Fish Swarm algorithm (AFSA), Ant Colony Optimization (ACO), Bee Colony Optimization (BCO), Cuckoo Search Algorithm (CS). In this paper, a firefly based optimization algorithm is proposed to optimize the threshold selected for region growing. The remainder of the section is organized as follows: Section II provides a general introduction about Firefly optimization algorithm.

2. FireflyAlgorithm

Firefly algorithm is a metaheuristic algorithm developed by Xin-She Yang in the year 2008, inspired by the flashing behavior of fireflies. This algorithm has three idealized rule[20]:

1. All the firfliesare unisex. So one firefly will be attracted to other fireflies regardless of theirsex.
2. Attractiveness is proportional to their brightness. Thus less bright one will move towards the brighter one.

ISSN 2581-7795

Brightness and attractiveness decreased as their distanceincreases.

3. Brightness of a firefly is affected or determined by the landscape of the objective function.
4. For maximization problem, the brightness can simply be proportional to the value of the objectivefunction.

3. ProposedMethod

3.1 RegionGrowing

In region growing neighboring pixels are compared with the initial seed pixels. Pixels with similar characteristics like color, intensity or texture are grouped with the seed pixel to form a region. The performance of the final segmented image depends on the initial seed pixel. Hence care should be taken while selecting the initial seed pixel. In our proposed segmentation algorithm, the given RGB image is converted into CIE L*a*b color space. CIE L*a*b space is a better model for human visual perception, which is justified by the fact that given two colors, the magnitude difference of the numerical values between them is proportional to the perceived differences as seen by the human eye [19]. This property is not associated with the RGB space. The converted L*a*b image is divided into several grids of equal size. The most frequent pixel is determined from the histogram and that pixel is selected as the initial seed pixel. A threshold value is chosen.Neighboring pixel which are less than this threshold value is grouped together to form a region.

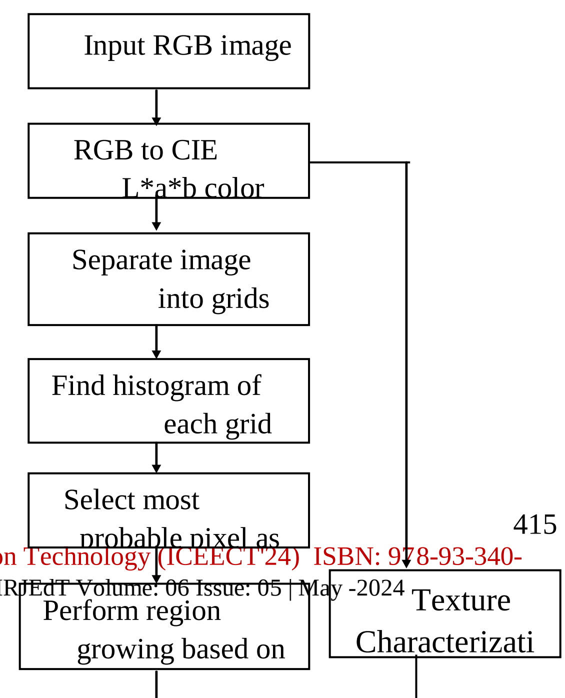
The main objective of this work is to optimize the threshold for region rowing process. The generated initial population contains randomly generated thresholds.

During initialization process, the initial population of fireflies (initial thresholds) was generated. Let n be the size of population and n is chosen as 10. The fitness of all the generated initial thresholds are evaluated using the fitness function explained in

The objective function is given as

$$f = max(NPR) \qquad (5)$$

To get the fitness value for Equation (5), the process of Region Growing segmentation explained in Sec(3.1) is carried out.



International Research Journal of Education and Technology
Peer Reviewed Journal
ISSN 2581-7795

Figure 1. Block diagram of the proposed region growing algorithm

The proposed segmentation algorithm was tested using the images taken from the publicly available Berkeley dataset. The input RGB image is converted to CIE L*a*b colorspace. For initial seed selection the gradient image issegregated into several blocks of size (8 x 4). Hence if the input image is of size (80 x 120), it is segregated into(10 x

If the inpu

(a) (b) (c)

4. Results andDiscussion:

Figure 3. a) Input Image. b) RGB to CIE L*a*b converted Image c) Initial Seeds d) Final Segmented output Image

segregatedinto (30 x 10) grids, with each grid of size (8 x 4). The most frequent pixel is selected as the initial seed pixel. To find out the most frequent pixel, the histogram analysis is done.. For each segregated grid, the histogram is generated individually and the most frequent pixel is now chosen as the initial seed pixel. Regions are grown based on the intensity

5. Conclusion:

A threshold optimization technique for region growing process is proposed in this paper. Regions are grown by computing the difference in intensity between the seed pixel and the neighboring pixel. The threshold for growing regions is optimized using firefly algorithm. To find out the optimum threshold, modified region growing algorithm is carried out by changing thresholds iteratively. Finally the threshold which maximizes the objective function is selected as the optimum threshold and segmentation is carried out. Experimentation is conducted on natural images and the results show the robustness of the proposedalgorithm.

REFERENCES:

[1] H. Cheng, X. Jiang, Y. Sun, and J. Wang, “Color image segmentation:Advances&rospects,” *Pattern Recognit.*, vol. 34, no. 12, pp.2259–2281, Dec.2001.

[2] N. Otsu, A threshold selection method from gray- level histogram, IEEE Transactions on Systems, Man, and Cybernetics vol. 9, no.1, pp. 62–66.(1979)

[3] A.K.C. Wong, P.K. Sahoo, A gray- level threshold selection method based on maximum entropy principle, IEEE Transactions on Systems, Man and Cybernetics vol.19, no.4, pp.641–647,(1989)

[4] H.D. Cheng, C.H. Chen, H.H. Chiu, H. Xu,

Fuzzy homogeneityapproachto multilevel thresholding, IEEE Transactions on Image Processing vol.7, no.7,pp.1084–1088,(1998)

[5] E. Saber et.al.,"Fusion of color and edge information for improved segmentation and edge linking," *Imag. Vis.Comput.*,vol. 15, no. 10, pp. 769–780, Jan. 1997.

[6] J. Basak,B. Chanda, On edge and linelinking with connectionist model, IEEE Transactions on System, Man, and Cybernetics vol.24, no.3, pp. 413–428,(1994)

[7] A. Marteli, An application of heuristic search methods to edge and contour detection, Graphics and Image Processing vol.19,no.2, 73–83,(1976)

[8] V.S. Nalwa, E. Pauchon, Edgel aggregation and edge description, Computer Vision, Graphics, and Image Processing vol.40, no.1, pp. 79–94,(1987).

[9] A. Tremeau, N. Bolel, A region growing and merging algorithm to color segmentation, Pattern Recognition vol.30, no.7, pp.1191–1203,(1997).

[15]).

[16] C. Chu, J.K. Aggarwal, The integration of image segmentation maps using region and edge information, IEEE Transactions on Pattern Analysis and Machine Intelligence vol.15, no.2, pp. 1241–1252,(1993).

[17] J.F. Haddon,J.F. Boyce, Imagesegmentation by unifying region and boundary information, IEEE Transactions on Pattern Analysis and Machine Intelligence vol.12 , no.10. pp. 929–948,(1990).

[18] J. Chen, T. Pappas, A. Mojsilovic, and B. Rogowitz, "Adaptive image segmentation based on color and texture," in *Proc. Int. Conf. ImageProcess.*, vol. 3, pp. 777–780, Jun. 2002.

[19] J. Chen, T. Pappas, A. Mojsilovic, and B. Rogowitz, "Adaptive perceptual color-texture image segmentation," *IEEE Trans. Image Process.*, vol. 14, no. 10, pp. 1524–1536, Oct. 2005.

[20] Luis Garcia Ugarriza, Eli Saber, SreenathRaoVantaram, Vincent Amuso, Mark Shaw, andRanjitBhaskar," Automatic Image Segmentation by Dynamic Region Growth and Multiresolution Merging" *IEEE Trans. Image Process.*, vol. 18, no. 10, pp. 2275–2288, Oct.2009.

[21] X. S. Yang, *Nature-Inspired Metaheuristic Algorithms*, Luniver Press, UK,2008.

[10] Frank Y.Shih, ShouxianCheng, Automatic Seeded Region Growing for color image Segmentation, Pattern Recognition vol. 23, pp. 877-886,(2005).

[11] Luis Garcia Ugarriza, Eli Saber, SreenathRaoVantaram, Vincent Amuso, Mark Shaw, RanjitBhaskar, Automatic Image Segmentation by Dynamic Region Growth and Multiresolution Merging, vol.18, no.10, pp. 2275-2009,(2009).

[12] S. Wan and W. Higgins, "Symmetric region growing," *IEEE Trans.Image Process.*, vol. 12, no. 9, pp. 1007–1015, Sep.2003.

[13] J.Fan, DavidK.Y.Yau, AhmedK.Elmagarmid, WalidG.Aref, Automatic Image Segmentation by Integrating Color-Edge Extraction and Seeded Region Growing, IEEE transaction on Image Processing, vol. 10, no. 10 1454-1466,(2001).

[14] T. Pavlidis, Y.T. Liow, Integrating region growing and edge detection, IEEE Transactions on Pattern Analysis and Machine Intelligence vol.12, no.3, pp. 225–233, (1990